DOUBLE TRACK TRUNION BASCULE BRIDGE FOR ELECTRIC CARS

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Single leaf, double track
trunion bascule bridge for

THESIS

A SINGLE LEAF, DOUBLE TRACK TRUNION
BASCULE BRIDGE FOR INTERURBAN
ELECTRIC CARS.

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to the

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THESIS.

Design and General Drawings
of a
Single Leaf - Double Track Trunion
Bascule Bridge for Interurban Cars.

Length of Span, 110 ft. from pin to free end.

Circular Segment, 35 ft. radius.

Clear Span, 75 ft.

5 Panels at 20 ft.

1 Panel at 10 ft.

Height of truss - at free end - 25 ft.

Height of truss - at pin end - 35 ft.

Width - 27 ft. c to c of trusses.

Sidewalks - 5 ft. wide.

Overall width - 39 ft.

LOADING.

Cooper's Class B. Suburban or Interurban Bridges.

For Trusses - Loads as per Table A.

Live Panel Load 48000 lbs.

SPECIFICATIONS.

American Railway Engineering & Maintenance of Way Association.

STRINGERS.

The timbers and flooring were designed first and the weight per stringer calculated.

INTERMEDIATE STRINGERS.

Max. L.L. Bending Moment = 466200 in.lbs.

Max. D.L. " " = 53300

Total " " = 519.500 in.lbs.

$$M/S = I/C = \frac{519500}{16000} = 32.3$$

Use 12" @ 31.50# I-beams with I/C = 36

TROLLEY STRINGERS.

Max. L.L. Bending Moment = 810,000

" D.L. " " = 120,450

L.L. Impact = 760,000

Total = 1.690,450 inch.lbs.

D.L. End Shear = 2150

L.L. " " = 9000

Impact = 8450

Total = 19600 #

Section used - 4 angles 4"x 4" x ½"

1 web. plate 20" x 3/8"

FLOOR BEAM.

Max. D.L. Bending Moment = 1,225,000

" L.L. " " = 3,756,000

Impact = 3,440,200

Total = 8,421,200 inch.lbs.

FLOOR BEAM (cont.)

D.L. End Shear = 14280

L.L. " " = 45000

Impact = $\underline{41500}$

Total = 100780#

Section used 4 angles 6" x 6" x 13/16"

1 web plate 36" x 3/8"

Bridge Closed.

DEAD LOAD STRESSES - COEFFICIENTS.

The counter weight was considered as balancing the D.L. of the bridge to give zero reaction at the free end with bridge unloaded. A D.L. of 1 kip was assumed at each panel point and the D.L. stresses figured analytically, considering the moving leaf as a cantélever. These stresses were used as a table of coefficients when the correct D.L. was figured. See Table 1.

LIVE LOAD STRESSES - COEFFICIENTS.

The L.L. stresses were figured with a L.L. of 1 kip moving from the free end to the pin. The L.L. stresses were also figured with the L.L. moving from the pin to the free end. See Table 1.

THE ABUTMENTS.

The piers and the abutments were designed considering the weight of the bridge, water pressure, and earth pressure. The resultant of these forces fell within the middle third of bases.

LATERAL SYSTEMS.

The stresses in the lower chord lateral bracing were figured from a W.L. per panel of 8800#. The train load - cars end to end - = 2400# per lin. ft. of one track. Lateral force on loaded chord = 200# per lin. ft. + 10% of train load on one track

= 200 + 240 = 440# per lin.ft. moving load

20 x 440 = 8800# W.P.L.

The stresses in the upper lateral bracing were figured from a moving load of 200# per lin.ft.

W.P.L. = 4000#.

The lateral systems were figured as cantelever trusses.

Bridge Open.

DEAD LOAD STRESSES - COEFFICIENTS.

The bridge was considered raised at an angle of 79° with the horizontal and the D.L. stresses scaled graphically, using one kip at the panel points. The stresses were tabulated as coefficients.

WIND LOAD.

A wind load of 25# per sq.ft. was considered as acting perpendicular to the floor surface. The W.L. stresses from top of bridge perpendicular to floor

have the same coefficients as D.L. stresses for bridge closed, assuming W.L. of 1 kip per panel. W.L. Stresses, with wind from bottom of bridge perpendicular to floor, were scaled graphically. See Table 1, bridge open.

Approximate Stresses.

The D.L. per panel of the North Avenue Bridge and the Archer Avenue Bridge was obtained and used as a basis for assuming the D.L. per panel of this bridge.

A D.L. per panel of 19 kips was assumed and multiplied by the coefficients to obtain the approximate D.L. stresses. A table was made of the L.L., D.L., and W.L. Stresses with bridge open and closed, and the maximum + and − stresses figured for each member according to specifications for an alternating stress.

Next the members were designed and their total weight computed + 30% for details. The weight of flooring and laterals was added in and the total was found to be 27.5 kips D.L. per panel.

Corrected Stresses.

The D.P.L. was assumed as 28 kips and Table 2 made of all the stresses, and the members were redesigned.

TOTAL WEIGHT OF BRIDGE.

Weight of Members in Table 1.

9.8 kips	per	panel	- truss
17.5 "	"	"	- floor load
0.7 "	"	"	- laterals
28.0 "	"	"	- D.L. Maximum

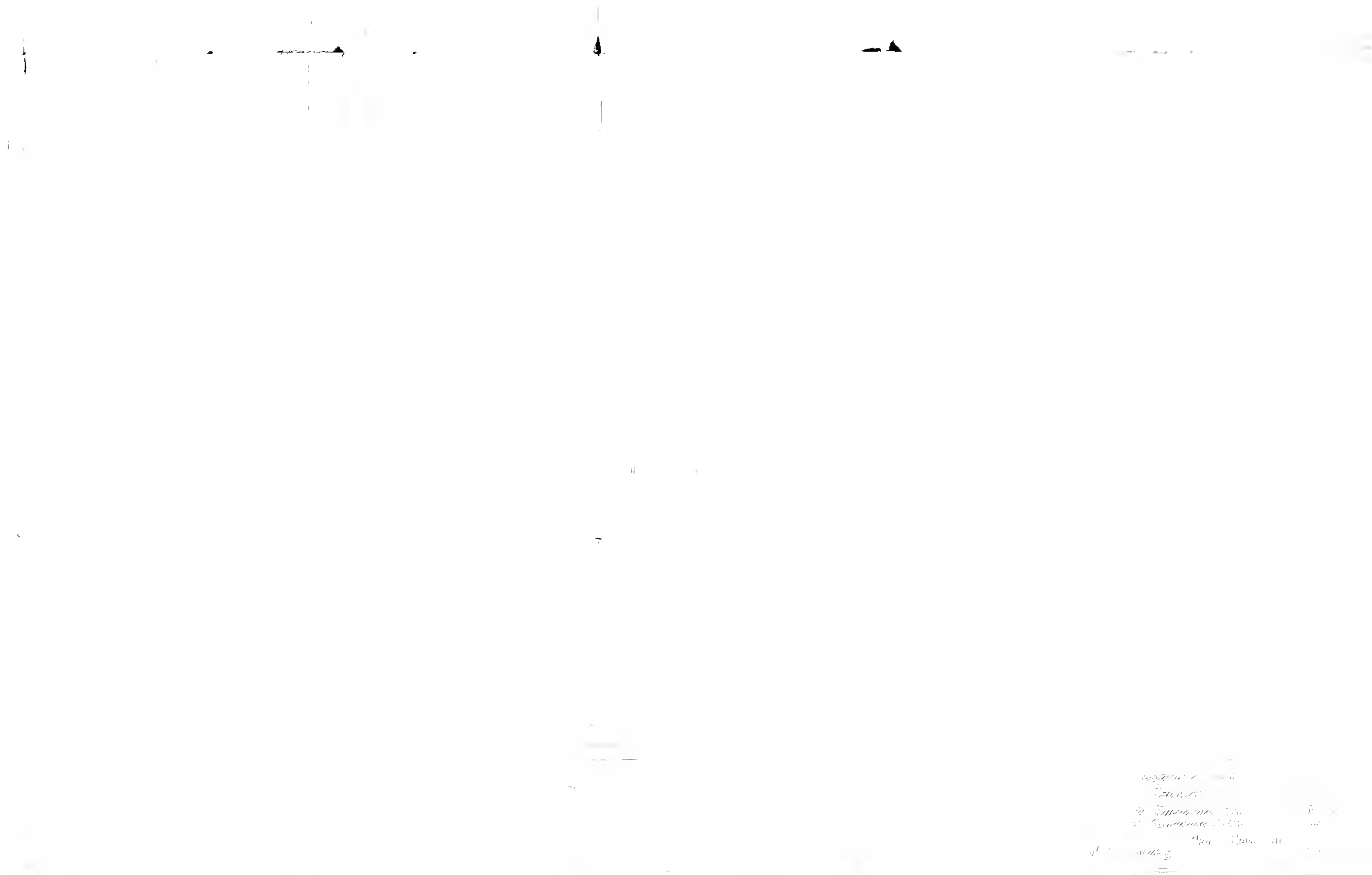
COUNTER WEIGHT.

The center of gravity of the bridge was located and the center of gravity of the counter weight was placed in line with it through the pin.

The sides of the counterweight box were designed as plate girders to carry the weight with bridge closed. The bottom of the box was designed as a plate girder to take the weight with bridge open.

PIVOT TRUSS.

The pivot trusses were designed to carry the weight of the bridge to the abutments and to support the roadway as far as the movable leaf.



12 1/2"